Aircraft Maintenance Management

Ir. Hadi Prayitno,S.ST, M.A | Dr. Gunawan Sakti , S.T, M.T
Ir. Ahnis Zulkarnain, S.ST, S.E, M.M | Hendri Louis Latif, S.ST, M.T

Aircraft Maintenance Management

Ir. Hadi Prayitno, S.ST, M.A, di lahirkan di Bandung, 16 Oktober 1975. Penulis saat ini menjadi Wakil Direktur I bidang Akademik, Ketarunaan dan Kerjasama di Akademi Penerbang Indonesia - Banyuwangi, salah satu sekolah kedinasan di bawah Kementerian Perhubungan. Saat ini sedang melanjutkan jenjang S3 (Doktor) bidang Pendidikan Vokasi di Universitas Negeri Surabaya. Penulis aktif sebagai peneliti dan penulis karya ilmiah yang diterbitkan dalam jurnal nasional maupun internasional terindex dan bereputasi diantaranya Sinta, *Scopus*, dan *Web of Sciences.* Penulis sejak 2021 juga aktif sebagai Pengajar kelas Internasional (*International Air Transport Association* – IATA) di *Centre of Human Resource Development on Civil Aviation* (Pusat Pengembangan Sumber Daya Manusia Perhubungan Udara) Curug – Indonesia, bidang *Aviation Safety* (Authorization Code : ID-CHR-01-20-001)

Dr. Gunawan Sakti, S.T, M.T, lahir di Tamanan, Magetan, Jawa Timur. Penulis saat ini sebagai dosen di Politeknik Penerbangan Surabaya, sejak tahun 2019 hingga sekarang. penulis juga terlibat sebagai mitra bestari atau *reviewer* di jurnal *Ocean Engineering, Elsevier,* terindex *Scopus Quartile 1* (*Q1*) sejak 2023 hingga sekarang dan telah menyelesaikan *reviewing* 6 jurnal. Karya ilmiah yang paling diunggulkan adalah *Improving the performance of Savonius wind turbine by installation of a circular cylinder upstream of returning turbine blade* terbit di jurnal *Alexandria Engineering Journal* pada tahun 2020 dan sudah dikutip sebanyak 26 kutipan hingga saat ini. Bidang Ilmu yang penulis tekuni adalah Aerodinamika dan penerapannya dalam industri penerbangan, bidang rekayasa konversi energi.

Ir. Ahnis Zulkarnain, S.ST., S.E., M.M., lahir di Jakarta pada tanggal 18 April 1990.

Penulis adalah alumni Sekolah Tinggi Penerbangan Indonesia dari Program Studi Diploma IV Teknik Pesawat Udara Angkatan ke-7, lulus pada tahun 2012.Saat ini, penulis sedang menempuh program master double degree di Fakultas Teknik Mesin dan Dirgantara (FTMD) Institut Teknologi Bandung dan International Air Transport Operations Management (IATOM) di Ecole Nationale de l'Aviation Civile. Penulis juga memiliki pengalaman magang di pabrikan pesawat *Avions de Transport Regional (ATR), Blagnac,* Prancis.

Hendri Louis Latif, S.ST, M.T, lahir di Jakarta,

Penulis saat ini aktif sebagai dosen di Politeknik Penerbangan Makassar. Penulis telah mengikuti beberapa pelatihan kompetensi baik dalam dan luar negeri, diantaranya *Train of Trainer Human Factor* di Bangkok Thailand Pada tahun 2016, *type rating training ATR72-Series dan Engine PT6* di Makassar pada tahun 2019, *Type Training Cessna 172 dan Engine Lycoming O360* Pada tahun 2018. Penulis aktif sebagai peneliti dan penulis karya ilmiah yang diterbitkan dalam jurnal nasional maupun internasional terindex dan bereputasi diantaranya Sinta.. Bidang Ilmu yang penulis tekuni adalah Piston Engine dan Aircraft Structure.

eureka
media aksara
Anggota IKAPI
No. 225/JTE/2021

0858 5343 1992
eurekamediaaksara@gmail.com
Jl. Banjaran RT.20 RW.10
Bojongsari - Purbalingga 53362

ISBN 978-623-120-670-1
9 786231 206701

AIRCRAFT MAINTENANCE MANAGEMENT

Ir. Hadi Prayitno, S.ST., M.A.
Dr. Gunawan Sakti, S.T., M.T.
Ir. Ahnis Zulkarnain, S.ST., S.E., M.M.
Hendri Louis Latif, S.ST., M.T.

PENERBIT CV. EUREKA MEDIA AKSARA

AIRCRAFT MAINTENANCE MANAGEMENT

Penulis : Ir. Hadi Prayitno, S.ST., M.A.
Dr. Gunawan Sakti, S.T., M.T.
Ir. Ahnis Zulkarnain, S.ST., S.E., M.M.
Hendri Louis Latif, S.ST., M.T.

Desain Sampul : Ardyan Arya Hayuwaskita

Tata Letak : Uli Mas'uliyah Indarwati

ISBN : 978-623-120-670-1

Diterbitkan oleh : **EUREKA MEDIA AKSARA, MEI 2024**
ANGGOTA IKAPI JAWA TENGAH
NO. 225/JTE/2021

Redaksi:
Jalan Banjaran, Desa Banjaran RT 20 RW 10 Kecamatan Bojongsari
Kabupaten Purbalingga Telp. 0858-5343-1992
Surel : eurekamediaaksara@gmail.com
Cetakan Pertama : 2024

PREFACE

We offer praise and gratitude to Allah SWT for the abundance of His blessings and gifts that have been given so that the author succeeded in completing the book well. The book entitled **"Aircraft Maintenance Management"** was prepared to helping students, lecturers and the general public who are looking for references related to Aircraft Maintenance Management.

The book contains the following eight parts, 1) Introduction, 2) Principles of Management, 3) Aircraft Maintenance and Regulatory Requirements, 4) Maintenance Management Systems, 5) Forecasting Fundamentals, 6) Project Management, 7) Reliability Theory, 8) Material Provisioning Concept For A Repair Business in Aviation

This book may contain unintentional shortcomings or due to developments in science that the author is not yet aware of, so this book is still far from perfect. Therefore, we really hope for constructive input and suggestions to improve this book.

The author would like to thank all who have supported in completing this book. Especially those who have helped the publication of this book and have been entrusted with encouraging and initiating the publication of this book. Hopefully this book will be useful.

TABLE OF CONTETNS

LIST OF FIGURE

LIST OF TABLE

AIRCRAFT MAINTENANCE MANAGEMENT

Ir. Hadi Prayitno, S.ST., M.A.
Dr. Gunawan Sakti, S.T., M.T.
Ir. Ahnis Zulkarnain, S.ST., S.E., M.M.
Hendri Louis Latif, S.ST., M.T.

UNIT 1 | INTRODUCTIONS

A. Learning Objectives

Upon completion of the learning, the students, will be able to implement principles of management in aircraft maintenance, will have sufficient knowledge and be able to use and integrate tools for filling out managerial position in aircraft, will be able to identify and find out other knowledge and skill required in aircraft maintenance.

B. Linked Learning Subject

Other learning subjects required to support in carrying out duties of managerial position in aircraft maintenance :

1. Production planning and control
2. Facility layout
3. Statistics
4. Quality control
5. Quality assurance
6. System engineering and analysis

C. Learning Subjects

Unit 1 : *Introduction*
Unit 2 : *Principles of Management*
Unit 3 : *Aircraft Maintenance and Regulatory Requirements*
Unit 4 : *Implementing Principle of Management in Aircraft Management*

UNIT 2 | PRINCIPLES OF MANAGEMENT

A. Development of Management Thought and Practice

1. Management by custom
   a. Current managerial tasks should be basically be thought of and performed in a manner similar to those of recent past/custom tradition.
   b. How would my predecessor have solved such a problem.
2. Scientific management school
   a. Uses the scientific method which verifies or reject assumptions by use of controlled experimentation.
   b. Experiments or tests are conducted under specific condition to discover causal relationship between assumption and the results obtained from the tests.
3. Behavior school
   a. Human is believed the really important entity of management.
   b. "Management does not do, it gets other to do."
   c. Need for manager to use that the best human relation practices – human relation practices – human relation, motivation, leadership, training and communication.
4. Social school
   a. Views management as social system/system of cultural relationship.
   b. The need to solve through cooperation the various limitations which humans and their environs may have.
   c. Stresses the interaction and cooperation and cooperation of people making up social entity.

UNIT 3

AIRCRAFT MAINTENANCE AND REGULATORY REQUIREMENTS

A. Why We Have To Do Maintenance

Entropy

1. The difference between the theoretically perfect system you have in the drawing board, and the actual, physical system you have in hand.
2. Constrains that may cause entropy :
   a. Technology/state of the art > saw blade vs laser beam, cable vs fibre optics, solid state transistors vs microchips.
   b. Economics > reduce tolerances, cheaper materials
      1) The more entropy, the more maintenance required reliability.
      2) Attainable level of perfection/designed-in level of perfection/inherent reliability.
      3) As good as the system gets during real world of operation.
      4) No amount of maintenance can be performed to increase the system reliability any higher than this inherent level.
      5) Desirable for the operator to maintain this level of reliability at all times.

Restoration of system perfection

1. Preventive / scheduled maintenance
   a. Curves a & b
   b. Return the entropy to its original level

UNIT 4 MAINTENANCE MANAGEMENT SYSTEMS

A. Introduction

Maintenance Management is an orderly and systematic approach to planning, organizing, monitoring and evaluating maintenance activities and their costs. A good maintenance management system coupled with knowledgeable and capable maintenance staff can prevent health and safety problems and environmental damage; yield longer asset life with fewer breakdowns; and result in lower operating costs and a higher quality of life.

This document provides general information and guidance on establishing Maintenance Management Systems for use in First Nations communities. It describes a system framework from the initial step of inventory gathering to preparing a community maintenance budget for asset maintenance planning and monitoring.

Depending on the application and design, Maintenance Management Systems may have various formats and procedures, (e.g., various formats of work orders, reports and computer screens, etc.), but the basic principles of all these systems are similar to the one presented in this document.

B. Types of Maintenance

The word "Operation" is usually linked with "Maintenance". To put these terms in context, Operation is the performance of work or services and the provision of materials and energy to ensure the day-to-day proper functioning of an

UNIT 5 FORECASTING FUNDAMENTALS

A. Fundamental Principles of Forecasting

Forecasting is a technique for using past experiences to project expectations for the future. n forecasting is not really a prediction, but a structured projection of past knowledge. There are several types of forecasts, used for different purposes and systems. Some are long-range, aggregated models used for long-range planning such as overall capacity needs, developing strategic plans, and making long-term strategic purchasing decisions. Others are short-range forecasts for particular product demand, used for scheduling and launching production prior to actual customer order recognition (Chapman, 2006).

B. Major Categories of Forecasts

There are two basic types of forecasting: qualitative and quantitative. Under the quantitative types, there are two subcategories: time series and causal. While this chapter provides basic descriptions of many of the common types of forecasts in all the categories, the primary focus is discussing quantitative time series forecasts.

1. Qualitative Forecasting

Qualitative forecasting, as the name implies, are forecasts that are generated from information that does not have a well-defined analytic structure. They can be especially useful when no past data is available, such as when a product is new and has no sales history. To be more specific, some of the key characteristics of qualitative forecasting data include:

UNIT 6 PROJECT MANAGEMENT

A. Introduction

1. What is Project ?

A project is a temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end. The end is reached when the project's objectives have been achieved or when the project is terminated because its objectives will not or cannot be met, or when the need for the project no longer exists. A project may also be terminated if the customer wishes to terminate the project. Temporary does not necessarily mean the duration of the project is short. It refers to the projects engagement and its longevity. Temporary does not typically apply to the product, service, or result created by the project most projects are undertaken to create a lasting outcome. For example, a project to build a national monument will create a result expected to last for centuries. Every project creates a unique product, service, or result. The outcome of the project may be tangible or intangible. Although repetitive elements may be present in some project deliverables and activities, this repetition does not change the fundamental, unique characteristics of the project work. For example, aircraft can be can maintenance with the same or similar materials and by the same or different teams. However, each aircraft maintenance project remains unique with a different location. different task card,

UNIT 7 RELIABILITY THEORY

A. Introduction

Reliability is The ability of an item is to perform a required function under given environmental and operational conditions for a stated period of time (ISO8402). Reliability theory developed apart from the mainstream of probability and statistics, which was used primarily as a tool to help nineteenth century maritime and life insurance companies compute profitable rates to charge their customers. The modern concepts in reliability engineering started from bathtub, which was found in the reliability study of vacuum tube – problematic parts in the WW2. Invented in 1904 by John Ambrose Fleming, vacuum tubes were a basic component for electronics throughout the first half of the twentieth century.

The reliability concepts except the quality control in product manufacture can focus on the study of quality itself in design. When mechanical system is subjected to random stress (or loads), mechanical structures are designed to withstand the loads with proper stiffness and strength. Requirements on stiffness, being the resistance against reversible deformation, may depend on their applications. Strength, the resistance against irreversible deformation, is always required to be high, because this deformation may lead to loss of functionality and even failure. It will uncover the faulty designs of product and modify them. Finally, it confirms whether the reliability of final designs is achieved (Woo, 2019).

UNIT 8

MATERIAL PROVISIONING CONCEPT FOR A REPAIR BUSINESS IN AVIATION

A. Introduction

The first chapter generally introduces the reader to the topic and provides information about the scope, delimitations and structure of this degree project.

The Repair Shop Business in Aviation

In general, the repair shop business can be described by the following cycle. The customer operates a primary product. During maintenance of this primary asset, the customer removes a component because its state is not capable for further operations. It is replaced by another component which is waiting on stock in order to get the primary product back to operations as soon as possible. In the meantime, the removed component is shipped to a repair shop. The repair shop conducts component maintenance. After that, the component is ready again for installation and can be sent back to the customer.

(Reinhard & (Ed.), 2018) illustrate the process about the repair component cycle:

REFERENCES

Agency, E. A. S. (2010). European Aviation Safety Agency. *Perspective*, *June 2009*, 2009–2011.

Baune, R., & Westphal, T. (2007). Optimierte Ersatzteillogistik durch Forecasting und flexibles Kapazitätsmanagement. *Erfolgreich Mit After Sales Services*, 241–249. https://doi.org/10.1007/3-540-34548-5_13

Chapman, S. N. (2006). *The fundamentals of production planning and control*.

Doikas, A. (2008). *Global-spare-parts-Management 2010: bringen Sie Ihre Ersatzteilversorgung weltweit auf Erfolgskurs*. IMPULS-Management-Consulting. https://books.google.co.id/books/about/Global_spare_parts_management_2010.html?id=GNVqPgAACAAJ&redir_esc=y

Haaß, M. (2009). *Entwicklung eines Optimierungsmodells für die Veränderungsplanung einer komplexen Ersatzteilwirtschaft*. Praxiswissen Service. https://www.lehmanns.de/shop/wirtschaft/11789980-9783869750033-entwicklung-eines-optimierungsmodells-fuer-die-veraenderungsplanung-einer-komplexen-ersatzteilwirtschaft

Heerd, A. (2006). *Beschaffungslogistik in Beispielen*. https://de.book-info.com/isbn/3-89936-532-1.htm

Jünemann, R. (2019). *Materialfluß und Logistik: Systemtechnische Grundlagen mit Praxisbeispielen*. Springer-Verlag.

Kaiser, U., Vogel, M., & Werding, A. (2003). Ersatzteilmanagement. In *Zeitschrift für wirtschaftlichen Fabrikbetrieb* (Vol. 98, Issue 12). https://doi.org/10.3139/104.100724

Kelly, A. (2006). *Plant Maintenance Management Set*. Butterworth-Heinemann. https://shop.elsevier.com/books/plant-maintenance-management-set/kelly/978-0-7506-6995-5

Kiausch, A. (2016). *Nachhaltiges Lieferantenmanagement mit Business Intelligence*. https://d-nb.info/110974563X/34

Koether, R. (2018). *TASCHENBUCH DER LOGISTIK* (5th ed.). Fachbuchverl. Leipzig im Carl-Hanser-Verlag. https://www.hanser-elibrary.com/doi/book/10.3139/9783446457676

Martin Quantsching. (2010). *Planungsmodell kostenoptimierter Versorgungsstrategien im OEM-Ersatzteilmanagement*. Shaker. https://books.google.co.id/books/about/Planungsmodell_kostenoptimierter_Versorg.html?id=qe5DcgAACAAJ&redir_esc=y

Molenaers, A., Baets, H., Pintelon, L., & Waeyenbergh, G. (2012). Criticality classification of spare parts: A case study. *International Journal of Production Economics*, *140*(2), 570–578. https://doi.org/10.1016/j.ijpe.2011.08.013

Nigel Slack, Robert Johnston, A. B.-J. (2011). *Operation Management*. Financial Times Prentice Hall.

Nigel Slack, A. B.-J. (2018). *Operation and Process Management* (5th ed.). Pearson Education. https://books.google.co.id/books/about/Operations_and_Process_Management.html?id=OPJFDwAAQBAJ&redir_esc=y

Nigel Slack, A. B.-J. (2019). *Operations Management*. Pearson Education. https://books.google.co.id/books/about/Operations_Management.html?id=wEqTDwAAQBAJ&redir_esc=y

P. Fraser Johnson, A. E. F. (2015). *Purchasing and Supply Management* (15th ed.). McGraw-Hill Education. https://books.google.co.id/books/about/Purchasing_and_Supply_Management.html?id=js83ngEACAAJ&redir_esc=y

Reinhard, & (Ed.), K. (2018). *Taschenbuch der Logistik*. HANSER. https://doi.org/https://doi.org/10.3139/9783446457676.fm

Schumacher, C. (2015). *Material Provisioning Concept for a Repair Business in Aviation*. https://www.diva-portal.org/smash/record.jsf?pid=diva2:856020

Slack, N. (2005). The flexibility of manufacturing systems. *International Journal of Operations and Production Management*, *25*(12), 1190–1200. https://doi.org/10.1108/01443570510633594

Sommerer, G. (1998). *Unternehmenslogistik: ausgewählte Instrumentarien zur Planung und Organisation logistischer Prozesse ; mit 11 Tabellen*. HANSER. https://books.google.co.id/books/about/Unternehmenslogistik.html?id=6O62PAAACAAJ&redir_esc=y

Thomas Spengler, Stefan Voß, H. K. (2004). *Logistik Management* (H. K. Thomas Spengler, Stefan Voß (ed.); 1st ed.). Physica Heidelberg. https://doi.org/https://doi.org/10.1007/978-3-7908-2689-0

van Jaarsveld, W. (2013). *Maintenance Centered Service Parts Inventory Control*.

Wannenwetsch, Helmut; Comperl, P. (2007). *Integrierte Materialwirtschaft und Logistik : Beschaffung, Logistik, Materialwirtschaft und Produktion ; mit 158 Tabellen und zahlreichen Fallbeispielen*.

Ward Romeijnders, R. T. and W. van J. (2012). *A two-step method for forecasting spare parts demand using information on component repairs*. *220*. https://doi.org/https://econpapers.repec.org/scripts/redir.pf?u=https%3A%2F%2Fdoi.org%2F10.1016%252Fj.ejor.2012.01.019;h=repec:eee:ejores:v:220:y:2012:i:2:p:386-393

Woo, S. (2019). Reliability Design of Mechanical Systems: A Guide for Mechanical and Civil Engineers, Second Edition. In *Reliability Design of Mechanical Systems: A Guide for Mechanical and Civil Engineers, Second Edition* (Issue January). https://doi.org/10.1007/978-981-13-7236-0

ABOUT WRITERS

Ir. Hadi Prayitno, S.ST., M.A., dilahirkan di Bandung, 16 Oktober 1975. Penulis saat ini menjadi Wakil Direktur I bidang Akademik, Ketarunaan dan Kerjasama di Akademi Penerbang Indonesia - Banyuwangi, salah satu sekolah kedinasan di bawah Kementerian Perhubungan. saat ini sedang melanjutkan jenjang S3 (Doktor) bidang Pendidikan Vokasi di Universitas Negeri Surabaya. Penulis aktif sebagai peneliti dan penulis karya ilmiah yang diterbitkan dalam jurnal nasional maupun internasional terindex dan bereputasi diantaranya Sinta, *Scopus*, dan *Web of Sciences*. Penulis sejak 2021 juga aktif sebagai Pengajar kelas Internasional (*International Air Transport Association* – IATA) di *Centre of Human Resource Development on Civil Aviation* (Pusat Pengembangan Sumber Daya Manusia Perhubungan Udara) Curug – Indonesia, bidang *Aviation Safety* (Authorization Code : ID-CHR-01-20-001).

Dr. Gunawan Sakti, S.T., M.T., lahir di Tamanan, Magetan, Jawa Timur. Penulis saat ini sebagai dosen di Politeknik Penerbangan Surabaya, sejak tahun 2019 hingga sekarang. penulis juga terlibat sebagai mitra bestari atau *reviewer* di jurnal *Ocean Engineering, Elsevier,* terindex *Scopus Quartile 1* (*Q1*) sejak 2023 hingga sekarang dan telah menyelesaikan *reviewing* 6 jurnal. Karya ilmiah yang paling diunggulkan adalah *Improving the performance of Savonius wind turbine by installation of a circular cylinder upstream of returning turbine blade* terbit di jurnal *Alexandria Engineering Journal* pada tahun 2020 dan sudah dikutip sebanyak 26 kutipan hingga saat ini. Bidang Ilmu yang penulis tekuni adalah Aerodinamika dan penerapannya dalam industri penerbangan, bidang rekayasa konversi energi.

Ir. Ahnis Zulkarnain, S.ST., S.E., M.M., lahir di Jakarta pada tanggal 18 April 1990. Penulis adalah alumni Sekolah Tinggi Penerbangan Indonesia dari Program Studi Diploma IV Teknik Pesawat Udara Angkatan ke-7, lulus pada tahun 2012.Saat ini, penulis sedang menempuh program master double degree di Fakultas Teknik Mesin dan Dirgantara (FTMD) Institut Teknologi Bandung dan International Air Transport Operations Management (IATOM) di Ecole Nationale de l'Aviation Civile. Penulis juga memiliki pengalaman magang di pabrikan pesawat *Avions de Transport Regional (ATR), Blagnac,* Prancis.

Hendri Louis Latif, S.ST., M.T., lahir di Jakarta, Penulis saat ini aktif sebagai dosen di Politeknik Penerbangan Makassar. Penulis telah mengikuti beberapa pelatihan kompetensi baik dalam dan luar negeri, diantaranya *Train of Trainer Human Factor* di Bangkok Thailand Pada tahun 2016, *type rating training ATR72-Series dan Engine PT6* di Makassar pada tahun 2019, *Type Training Cessna 172 dan Engine Lycoming O360* Pada tahun 2018. Penulis aktif sebagai peneliti dan penulis karya ilmiah yang diterbitkan dalam jurnal nasional maupun internasional terindex dan bereputasi diantaranya Sinta.. Bidang Ilmu yang penulis tekuni adalah Piston Engine dan Aircraft Structure.